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The Role of the Public in Adaptive Ecosystem Management

ABSTRACT

The role of the public in adaptive approaches to natural resource management is reviewed and discussed. Two approaches to adaptive management are observed: participation-limited, where the public is generally excluded from active involvement; and integrated adaptive management, where the public plays an active role along with managers and scientists. Integrated adaptive management is a process where the public works iteratively and continuously with managers and scientists, and public input is genuinely integrated into the process and evaluated on a par with other information. Implementation of integrated adaptive management is explored with a focus on identifying subgroups of the public and describing appropriate methods for providing active roles for the public. The public participation process used in Sierra Nevada Ecosystem Project is described to illustrate elements of a successful integrated adaptive process. Guidelines for integrated adaptive management emphasizing active roles for the public are presented and discussed. Integrated adaptive management offers opportunities to effectively involve stakeholders in the development of reasoned solutions to resource management problems.

INTRODUCTION

Adaptive ecosystem management is increasingly discussed by scientists and managers as a new approach to resource management. Those who use this approach acknowledge uncertainty in ecosystem management, embrace an experimental perspective to learning, and understand that it requires

new roles and relationships to be developed for scientists and managers. Adaptive ecosystem management is important because it addresses incomplete knowledge and uncertainty associated with ecosystem processes and has the potential to address the political and social components of management. Compared to traditional approaches to resource management, adaptive management is more responsive to changing conditions of and demands on ecosystems. Relationships and responsibilities of the public in adaptive ecosystem management, however, have only recently received attention, and the importance of the public's role has yet to be fully realized.

We begin by describing adaptive management and argue that successful adaptive ecosystem management must include a new and active role for the public that approaches that of scientists and managers, within legal and practicable limits. Moreover, public input must be considered on a par with other information and genuinely integrated into the adaptive process. In our discussion of adaptive management we describe the roles and relationships of scientists, managers and the public and how they differ in traditional—primarily federal—land management, and in two general models of adaptive processes. To further illustrate integration of the public into an adaptive process, we describe public participation in the Sierra Nevada Ecosystem Project (SNEP) which was based on adaptive principles and resulted in a new relationship between the public and project scientists.

Based both on the SNEP experience and research in public involvement in natural resource management, we conclude with guidelines for integrated adaptive processes. Much of the research and experiences in public involvement cited in this paper are based in federal land management because of mandated public involvement requirements. Adaptive pro-

Sierra Nevada Ecosystem Project: Final report to Congress, vol. II, Assessments and scientific basis for management options. Davis: University of California, Centers for Water and Wildland Resources, 1996.

cesses, however, can and have been successfully applied in private as well as public land management.

WHAT IS ADAPTIVE MANAGEMENT?

Adaptive management is a term widely used and one with at least several forms and interpretations. Everett and colleagues (1993) present it as an essential component of "ecosystem management." Much of the recent discussion of adaptive processes in natural resources has evolved from the work of C. S. Holling and others in their description of an adaptive framework for environmental assessment and management. Holling (1978) characterizes the adaptive approach as "an interactive process using techniques that not only reduce uncertainty but benefit from it."

An underlying premise of adaptive management is that knowledge of the system managed is not only incomplete but elusive (Walters and Holling 1990). This is particularly relevant in management of ecosystems such as those in the Sierra Nevada where complexity is both highly dynamic and scientifically daunting. Within this uncertain environment, management actions must be designed not only to meet specific objectives but to also yield knowledge and address social goals (Walters and Holling 1990; Lee 1993). By focusing on the refinement of knowledge through management, learning is achieved through the experience of management itself rather than solely through basic research or theory development (Walters 1986; Lee 1993). Bormann and colleagues (1994) describe this as "learning to manage by managing to learn." Thus, at its core, an adaptive process both focuses and accelerates learning to create more effective management.

Critics may argue that adaptive management is a new name for traditional approaches to resource management. Certainly, natural resource management and policy have always been revised based on past successes and failures. Yet changes are frequently crisis motivated and reactive in nature. Bormann and colleagues (1994) assert that learning associated with reactive change is too slow to deal with rapidly changing issues. Consequently, a shift to an adaptive approach in resource management suggests a fundamental change in how learning takes place and how the "system" under management is approached. Walters and Holling (1990) identify three approaches to adaptations in resource management: incremental, passive, and active adaptive management. Incremental management approaches evolve from a reduced set of previously tried techniques, or trial and error. Passive adaptations are based on historical information that form a single best approach along a linear path assumed to be correct. Both of these approaches are typical of traditional management in their linear approach to change and failure to plan to learn.

As described by Walters (1986) and Walters and Holling (1990), "active" adaptive management differs from traditional management approaches through the purposeful integration of experimentation into policy and management design and implementation. Policies and management activities designed in an adaptive framework are specifically treated as experiments and opportunities for learning (Lee 1993). Establishment of procedures for evaluating a range of management actions is a critical component of adaptive management and must be part of the original design, not simply an afterthought (Holling 1978). Consequently, a shift to an adaptive approach in resource management suggests a fundamental change in how learning takes place and how the "system" under management is approached. In summary, adaptive management is defined here as a process for acting deliberately under uncertainty by increasing opportunities to develop new information and redirecting management actions in a timely manner. Management actions are designed not only to meet specific objectives but also as learning experiences that focus on the constant re-evaluation of goals, objectives and perceptions of processes as new information is developed.

PRIMARY GROUPS, ROLES, AND RELATIONSHIPS IN ADAPTIVE PROCESSES

The purposeful integration of experimentation into policy and management design and the creation of sustained learning processes through adaptive management require, among other things, a redefinition of the relationships among three primary groups of participants: scientists, managers, and the public. We begin this section by describing these three groups. We then explain how the public was addressed within three subgroups in the Sierra Nevada Ecosystem Project to offer one example of how the public might be more effectively integrated into an adaptive process.

The relationships between scientists, resource managers and the public highlight fundamental distinctions between traditional natural resource management and adaptive processes, and, additionally, are used to further identify two types of adaptive management: participation-limited and integrated adaptive management. *Traditional natural resource management* processes, even those with public involvement components, typically do not foster working relationships between the public and managers and make no attempt to encourage relationships between the public and scientists (figure 20.1). Adaptive processes, on the other hand, are fundamentally about changing the relationships between these three groups. *Participation-limited adaptive management* focuses principally on the relationship of scientists and managers (figure 20.2), while *integrated-adaptive management*, as we define it here, requires a new role for the public that includes the establish-

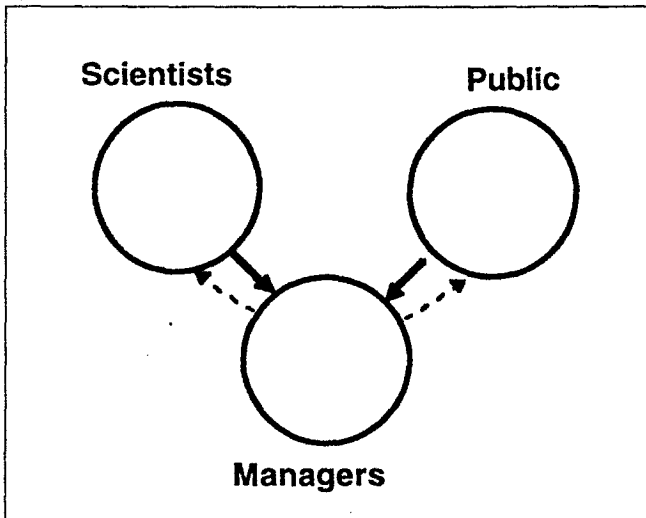


FIGURE 20.1

Traditional management.

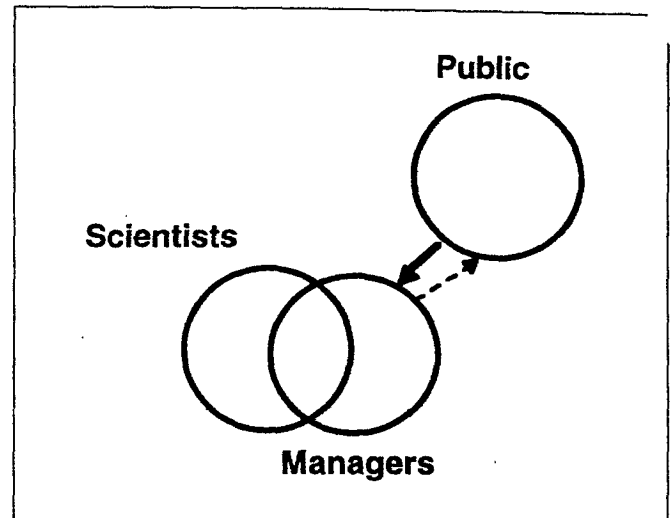


FIGURE 20.2

Participation-limited adaptive management.

ment of active working relationships between managers, scientists and the public (figure 20.3). We conclude this section with a discussion of SNEP public participation activities that helped build a new collaborative relationship between scientists and the public.

The Primary Groups in Adaptive Processes

Scientists, managers and the public make up the three primary groups in this discussion of adaptive management. *Scientists* include individuals and organizations that typically engage in scientific research. The scientific community includes individuals with training and expertise in experimental design and methods testing. Scientists may be found within management organizations as well as within separate institutions of learning, research and development. *Managers* include individuals and organizations endowed with the responsibility and authority to manage or regulate the land and resources that are under consideration for management action. This group includes higher level policy makers as well as field managers and related staff of federal, state and private organizations with resource management responsibilities. *The public* includes other individuals and organizations that are not included in the groups of managers or scientists. The public, as a group, includes a diverse array of interests.

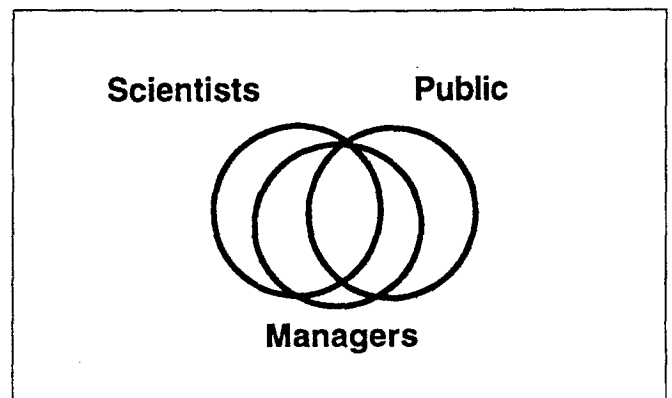
It is useful to further identify the primary subgroups within the public in order to address better their needs and interests as well as the various skills and knowledge they might bring to a particular process. One useful dichotomy distinguishes two principal communities within the public: communities-of-place and communities-of-interest. Communities-of-place include members of the public who may be affected by or interested in management decisions and actions by nature of

their residency within or near management activities. For example, residents of the community of Lee Vining in the Eastern Sierra, organized to affect management of Mono Lake, represent a place-based group. Communities-of-interest include groups with a focused interest in (often accompanied by organized efforts to influence) management of resources unrelated to their member residence. Such groups are "communities" through this shared interest. Groups in this category include regional and national-level organizations with broad constituencies, many of whom often reside in urban areas. Examples of groups with interests in the Sierra Nevada include the Sierra Club, Women in Timber, California Forestry Association, and Audubon Society.

It is possible for an individual to be a member of both a community-of-interest and a community-of-place, an example being a resident of Lee Vining who is also a member of the

FIGURE 20.3

Integrated adaptive management.



Mono Lake Committee. Similarly, a member of the Quincy Library Group, a place-based group in the Northern Sierra, who is also a member of the California Forestry Association is part of both a community-of-interest and a community-of-place. Depending on how broadly communities-of-place and -interest are defined, this public dichotomy—while quite useful—may not be entirely inclusive.

The Public in SNEP Public Participation

Three distinct types of public groups were targeted in the SNEP public participation effort: key contacts; collaborative place-based groups; and the general public. Identification of the first two groups was based on the dichotomy of communities-of-interest and communities-of-place, respectively. Because these two groups were more narrowly defined by SNEP and due to the broad nature of the SNEP study, a third more general category for the public was also identified. Distinct activities were developed for each of these groups.

The charter for the Sierra Nevada Ecosystem Project recommended that the team rely on a group of key contacts to help accomplish project objectives. The initial key contact group consisted of individuals who participated in previous planning and evaluations of the Sierra Nevada (e.g., the Sierra Summit Steering Committee and Sierra Nevada Research Planning Team). Additional individuals were added to the group as the team identified regions or areas of interests that were not represented. Communities-of-interest participated in SNEP as members of the key contact group and independently in team meetings with the general public. The key contact group totaled approximately 100 individuals representing various interest groups, scientific or other perspectives within the communities-of-interest of the Sierra Nevada. A sub-group of about a dozen key contacts assisted the SNEP public participation team in planning meetings with the general public and key contacts during the final year of the project. A diversity of interests were also represented in this sub-group, including recreation groups, public agencies, timber industry, and the environmental community.

Place-based collaborative groups, which focus efforts in communities "placed" in the Sierra, were selected as focal points for SNEP's local public participation activities. Collaborative place-based groups are defined as bioregional, community, or watershed-based groups with diverse interest representation that meet to discuss local resource management and well-being issues. While there are numerous communities-of-place within the Sierra, there are relatively few local collaborative groups experienced in maintaining a dialogue among diverse interests. These collaborative groups were selected as focal points for the SNEP public participation effort because of diverse perspectives, a high level of understanding of natural resource issues, and because of a belief that these groups will play an increasingly important role in resource management in the Sierra. Additionally, the team felt that members of these

groups could effectively contribute local and regional knowledge and act as catalysts for additional local public involvement in SNEP.

The general public includes all other individuals not specifically included in the key contact or place-based groups. Although limited resources constrained SNEP's work with the public, working relationships with both the key contacts and the place-based groups helped to draw and focus general public interest and participation.

Relationships between Scientists, Managers and the Public: Traditional Natural Resource Management and Adaptive Processes

Non-Adaptive Approaches

In traditional (non-adaptive) natural resource management, an approach common with federal land management and particularly national forest planning in the 1970s and 1980s, managers operate in relative isolation and bear the responsibilities of planning, decision-making, and implementation within a closed system. Plans and decisions are based on traditional practices and available scientific knowledge from the research community. The scientific community is generally left largely on its own to design and engage in research that may or may not contribute to future management and decision-making. Though some research may be specifically linked to land management activities, scientists and managers generally do not directly interact.

Although many traditional management approaches include "public involvement" programs, the rigidity and formality of these programs typically preclude active involvement of the public in resource planning, management or decision-making. Over the last three decades, public involvement in federal land management has been generally treated as both a mandated activity and a necessary evil rather than as part of an active process integral to learning and successful management. While a major thrust of opening federal and state environmental decision-making to the public was to increase government accountability and responsiveness to citizens, there is considerable evidence that public input too often was not taken seriously or was integrated inadequately into decisions (Blahna and Yonts-Shepard 1989; Rosenbaum 1976; Wondolleck 1988). Agency responses to mandated requirements were often formal and characterized by rigid compliance with procedures, since satisfying legal requirements frequently held higher priority than meeting the spirit of the law. Staff hired to coordinate public involvement were separated from resource specialists and managers, and in the interests of "fairness" and "objectivity," public comments were analyzed, synthesized, coded, counted, and removed from their vital contexts. Agencies often took the role of neutral arbiter in processes that, by design, promoted adversarial relations among various interests (Wondolleck 1988). Moreover, the only opportunity for public comment was with draft de-

cisions, too late to permit real integration of public input—which otherwise should have taken place during formulation of project objectives, approach and design—as these decisions were “draft” in name only (Krannich et al. 1994; Wondolleck 1988).

Adaptive Approaches

Inherent in adaptive processes is a general recognition of the need to redefine traditional roles and relationships of the primary players in natural resource management. Redefinition is unclear, however, because the public's role in adaptive management and the relationship of the public to scientists and managers has not been well defined. Two general models of adaptive processes for ecosystem management can be distinguished based on who is actively involved: a more commonly recognized participation-limited approach focusing principally on the activities and interactions of scientists and managers; and an integrated adaptive management approach that creates active roles for the public and the research community and requires new and active relationships between managers, scientists and the public.

Participation-Limited Adaptive Management. Participation-limited adaptive management focuses on the collaborative relationship between managers and scientists in the design, implementation and monitoring of adaptive policies. Describing the use of workshops in an adaptive assessment process, for example, Holling (1978) states that it is critical to have all “prime actors” present, yet he includes only scientists, managers, and “policy people” in his discussion. Lee (1993) describes adaptive management as a process where managers work closely with scientists to collect and analyze information and improve understanding. Bormann and colleagues (1994) refer to a need to “blur” the institutional boundaries between research and management. To design management plans as experiments, Holling (1978) calls for a “more elaborate and productive interplay” between scientists and decision-makers. For Holling, scientists provide a certain level of rigor and understanding of fundamental processes, and managers provide a balance to “scientist's penchant for exquisite detail and excessive resolution.”

Participation-limited adaptive management includes adaptive processes and demands a new relationship between scientists and managers, but, similar to traditional resource management, it does not actively include the public in the process. The merging of science and management is a productive step, but by limiting active participation to scientists and managers, it becomes a technocratic approach, that alone is inadequate. Walters (1986) points out that traditional scientific programs tend to focus on previously validated tools and methods, leaving many research paths untouched. In a case study analysis of three adaptive management processes

in the Northwest, McLain and Lee (1994) indicate that the effectiveness of these adaptive approaches is hampered by a failure to address the role of diverse stakeholders, and, it is important to add, diverse values. They point out that little attention has been given to the types of institutional procedures that can facilitate the incorporation of social values and processes in adaptive management.

Integrated Adaptive Management. In integrated adaptive management the public is included in the adaptive process and provided an active role that approaches that of managers and scientists. Bormann and colleagues (1994) suggest that successful adaptive management of ecosystems will require collaboration, coordination and information sharing among all interested parties, including the public. They point out that adjacent landowners and various social communities will be more accepting of management and will be more willing to take responsibility if they are given a greater role in shaping experimental management decisions (Bormann et al. 1994). Everett and colleagues (1993) propose that adaptive ecosystem management strategies should be developed through the collaborations of all relevant social communities, managers and the research community. Despite interest expressed in the literature in elevating the role of the public in adaptive processes, this role has been neither adequately elaborated or widely implemented.

In an integrated adaptive process, the public, managers and scientists iteratively work together to design, implement, monitor, evaluate and jointly assess management options in an adaptive process. The degree to which the public participates in each stage of the adaptive process will vary depending on the interests, skills and knowledge that the public brings to any one situation, as well as any legal and practicable constraints to their participation. More significantly, however, public input must be genuinely integrated into the adaptive process and assessed on a par with other information. Successful application of an integrated adaptive approach thus not only permits public access and actively encourages it at each stage, but also promotes earnest exchange of information among scientists, managers, and the public and the sincere integration of diverse stakeholder knowledge and social values into the process.

The advancement of the public's role in integrative adaptive management has the advantage over participation-limited approaches of recognizing the importance of social values in goal setting and the role and importance of an active public for learning. The emphasis of a participation-limited approach is often on resolving tensions between scientists and managers. Integrated adaptive management, on the other hand, recognizes the political nature of natural resource management and the necessity of involving the public in an active process of contributing and learning.

Why Integrated Adaptive Management?

We have characterized adaptive management as a process embodying deliberate management actions designed to increase opportunities for learning in order to redirect management with improved information. The process of adaptive management has also been described as a deliberate cycle of planning, acting, monitoring, evaluating, and adjustment (Forest Ecosystem Management Assessment Team 1993), and similarly, as a continuous system involving adjustment, linked actions, feedback, and information synthesis (Bormann et al. 1994). However the various steps in adaptive management might be described, the entire process moves forward through the advancement of ecological and social learning. As a mechanism for learning and acting, it is the creation, modification, interpretation and flow of information that connects each step with the next and provides a critical basis for communication between the various participant groups. Information and knowledge are both the foundation and a product of adaptive management. Bormann and colleagues (1994) recognize the unique information needs of adaptive management systems by elevating information to a status equal to or greater than traditional resources.

Integrated adaptive management emphasizes active public participation in this evolution and flow of information. Integrated adaptive management requires a shift away from public participation as a discrete activity for involving the public to a process-oriented approach that calls for maximizing opportunities for the public to gather, modify, synthesize, evaluate, design, learn from and avail themselves of information related to the ecosystem processes and management decisions at hand.

Transcending both traditional management and participation-limited adaptive management, integrated adaptive management offers the public both a significant role and a permanent one. The public is not brought in occasionally simply to bless or critique a plan, rather it is invited to help design, monitor and evaluate in an iterative process. Given clear roles in each phase, the public becomes a partner with managers and researchers in a continuous process of experimentation, learning and management. There are three fundamental reasons why adaptive ecosystem management must include active roles for the public.

1. *As sources of information and knowledge.* The collection and interpretation of information is fundamental to the adaptive management process (Lee 1993). The research community is the primary source for scientific information and interpretation, and managers offer experiential knowledge. The public, however, also has a critical role as a source of information. First, landowners, local residents and communities-of-place offer a wealth of knowledge regarding local attributes and ecological and social processes affecting an ecosystem. Second, the public is a source of information on social values and can also act as filters for

interpreting information on social values that are collected at a broader scale.

2. *To build trust and broaden support.* The dynamic nature of adaptive management necessitates that the public be allowed to actively participate in the process rather than simply be informed of it. Some may argue that adaptive management is too complicated for the public to understand. If this is the case, however, excluding them from the process will only result in greater confusion and distrust. "Adaptive management must take into account the broad array of public communities, and it must be interactive with the scientific discovery process rather than react to it" (Everett et al. 1993). Managing in an adaptive framework will not further social learning if the public is not part of the process. Additionally, excluding the public from adaptive ecosystem management means ignoring the political nature of land management, thereby increasing the likelihood that the process itself will not be supported.
3. *To generate ideas and question paradigms.* A primary theme of adaptive management is to "reject recipes and rituals in favor of a search for better processes to promote imagination and learning" (Walters 1986). Both scientists and managers tend to favor well-trodden paths. The public is more likely to question these favored approaches and can act as a catalyst for devising new ones. Greater societal participation can ultimately lead to a wider array of learning opportunities in natural resource management.

SNEP Public Participation as an Adaptive Process

Public participation in SNEP provides an example of how the public can be integrated in an adaptive process. The public was informed about the study and involved in SNEP through an adaptive exchange as the team iteratively sought and responded to public input. As an adaptive ecosystem management process, however, SNEP was unusual because there was no explicit role for managers, quite the opposite of what would be the case if it was a land-based adaptive process. Numerous managers did, however, participate in the SNEP adaptive process, but they did so by attending general public meetings or workshops.

Public participation in SNEP did not begin as part of an integrated adaptive process. Initially, SNEP public involvement bore closer resemblance to a narrow public participation process in traditional resource management. The first public meeting provides a striking example of this. At this meeting, following the release of the interim SNEP Progress Report, the public participated as listeners and were allowed to submit only written questions. The entire science team was seated facing the SNEP Steering Committee seated in the front of the room, with team members' backs to the public. The only interactions in the meeting were between members of the science team and members of the steering committee, ex-

cept for the written questions. Maintaining a distance between the science team and the public was supported by traditional views of many team scientists. They felt that public involvement would be messy and, worse, would compromise the independent scientific study.

Through a fairly dramatic evolution, over a period of approximately six months, public involvement in SNEP grew into an adaptive process. During this period, there were numerous conversations among team members in which the potential benefits as well as the risks of an adaptive process were discussed, and an outline of a public involvement plan was developed. One of the explicit goals of SNEP public participation, as it was redefined, was to promote mutual learning and a feedback process between scientists and the public.

The first SNEP team meeting with the key contacts was held after the first public meeting as a new public involvement strategy was being developed. At this meeting the team learned the importance of public access to scientists. Key contacts were able to question and engage scientists in discussions following individual presentations. Meeting breaks in many instances proved more valuable than the presentations themselves, as participants took these opportunities to discuss issues with scientists directly. During this meeting several key contacts volunteered to assist the SNEP public participation team in planning public meetings during the final year of the project. The key contact work group, as it came to be called, was instrumental in providing ideas on how to ensure productive interactions between SNEP scientists and the public in these additional meetings.

As redefined, the SNEP public participation strategy employed a diverse array of methods to provide meaningful roles and maintain continuous involvement with the public. The core of the public involvement strategy consisted of a multi-stage approach involving newsletters providing general information on project activities and preliminary findings, an open letter to the public requesting information and calling for public contributions to scenario development, meetings and workshops, and focused public reviews of draft assessments. The open letter resulted in forty-one public submissions, all of which were reviewed by the science team.

Meetings and Workshops

A series of public meetings and workshops were conducted with collaborative groups (and communities-of-place), key contacts (largely communities-of-interest) and the general public.

Two public meetings were held in succession within the geographical areas of each of the two collaborative groups. These meetings were co-hosted by the collaborative groups which made arrangements and ensured that the broader public was invited. The local meetings were attended by a subgroup of the science team representing a diverse range of disciplines that were of particular interest to the collaborative groups. Each meeting had a different complement of scientists. Brief presentations were made by members of the

science team on approaches and progress within their individual assessments. The last half of these two- to three-hour meetings was dedicated to informal questions and answers and to open discussion between scientists and attendees. The second meetings with the collaborative groups also included interactive demonstrations of some of SNEP's computer-based geographic information system (GIS) data. Notes were taken at all meetings to ensure that questions, concerns and suggestions from the public were captured, and these notes were later shared with the full team.

Two large public meetings were centrally held along with a separate workshop with the key contacts. Considerable time was allocated for interaction between scientists and the public at each of these meetings. The first public meeting under the integrated public involvement strategy focused on introducing the approaches used by scientists in the assessment and on discussions of preliminary findings. The full-day meeting began with formal presentations by some of the scientists, including questions from the public. Nearly three hours of the meeting were dedicated to an open workshop format where attendees were able to engage in discussions with scientists in small groups at tables organized by resources and disciplines. Included in this arrangement was an area dedicated to interactive demonstrations of some of SNEP's GIS data. Note-takers were again stationed at each table to capture the questions and suggestions offered by the public.

A special workshop was held with the key contacts to specifically solicit ideas regarding the development of policy scenarios. During this workshop, participants were briefed on a list of possible scenarios based on ideas drawn from responses to the open letter, previous public meetings, scientific models, and the team's resource assessments. Attendees were then divided into small groups composed of both scientists and key contacts. Led by SNEP facilitators, the groups discussed concerns and offered suggestions regarding scenario development. Notes were taken on poster sheets. Representatives from each group summarized their discussions to the full group. The dialogue captured in this workshop was used by the science team to both expand and refine the development of a suite of scenarios.

The final public meeting was scheduled to provide sufficient time to incorporate public comment gained during the meeting into the development of scenarios. This meeting offered an opportunity for the public to understand and evaluate the range of scenarios developed up to that point, and for the SNEP scientists to listen to the public's concerns, insights and suggestions. Scheduling additional time to incorporate public comment allowed the SNEP team greater opportunity to fashion scenarios which incorporated local expertise and better reflected public concerns. The round-robin type of interaction in which the public conversed with scientists face-to-face was repeated in this meeting. Following a few formal presentations by SNEP scientists, participants were given the opportunity to discuss scenarios and findings directly with scientists at tables organized by scenario focus and general

resource area. As with previous meetings, notes were recorded at each table to capture the questions and suggestions offered by the public, and circulated to the team shortly thereafter.

Reviews

Key contacts and place-based groups also participated in a *focused review of SNEP assessment reports*. Draft assessments were subjected to a blind peer review process and were simultaneously sent to key contacts and place-based groups, on request, for their review and comment. Key contacts and place-based groups coordinated public review of these drafts, taking responsibility for summarizing responses and returning them to the team within the same time period allotted peer reviewers. Similar to a formal peer review process, team scientists used comments received from the key contacts and place-based groups to inform subsequent revision of their assessments.

Other Interactions

The formal public involvement strategy detailed above was supplemented by a variety of other interactions between the individual scientists on the SNEP team and the public. Interactions were often intended to either inform the public of SNEP or gather specialized knowledge, but often accomplished both. These included meetings with agencies, private industry, county supervisors, and interest groups, a series of workshops with local experts to assess community capacity and well-being, and other workshops to identify and map late successional forest types. Scientists were encouraged throughout the process to meet with individuals and groups who had information and ideas that would assist project assessments.

The Success of SNEP's Integrated Adaptive Management Process

SNEP public participation succeeded as an adaptive process largely due to the development of an active role for the public and the advancement of an interactive relationship between the public and scientists. The scientists as well as the public benefited. Most SNEP scientists, including those who were initially skeptical of interaction with the public, found the public involvement process both instructive and valuable. Many scientists were influenced in a variety of ways by public interaction, and near project end virtually all scientists were positive about exchanges with the public. It is important to reiterate, however, that the SNEP process represents a limited example of adaptive ecosystem management because the study did not expressly include managers or address specific land management projects.

The incorporation of public ideas into the science team's work represented another success. Though it is impossible to pinpoint specific "public" ideas that influenced the scientists, it is clear that public involvement did influence the work of

the team. Numerous times in SNEP team meetings a scientist would reference a public comment to reinforce a point or make clear that the issue under discussion must be addressed to respond to public concern. Interaction with the public often influenced how data were presented and conclusions drawn, as well as influencing the development of scenarios.

Finally, the adaptive process itself had significant effects on the public as a group. Through their involvement, the public's perceptions of the science project itself changed. Individuals who initially felt the project was a waste of time later expressed a genuine concern that the best possible science be used to address the complex social and resource issues in the Sierra Nevada. Perhaps most importantly, people who had long been sitting on opposite sides of issues agreed that resolution of complex resource management issues would only be achieved with them working together and not against one another. There appeared to be broad agreement among these participants to continue the dialogue begun in this adaptive process after SNEP.

INTEGRATED ADAPTIVE MANAGEMENT: LESSONS FROM THE PAST, GUIDELINES FOR THE FUTURE

The complexity of resource issues, institutional environments, and diversity of stakeholders' values and knowledge, among other things, make clear that no single formula is sufficient to involve the public in integrated adaptive management. Guidelines for effective public involvement in an integrated adaptive management process, however, can be identified. The following guidelines are drawn in part from lessons learned from the successes and failures of public involvement in traditional federal land management activities and the fields of conflict resolution, conflict mediation and collaborative problem solving. Experiences in these fields reflect a trend in public participation towards adaptive processes and are discussed in more detail in appendix 20.1. It is, in fact, many of these lessons that informed the approaches and activities used to involve the public in SNEP.

Involve the Public Early

Public participation in natural resource management has proven to be most effective if it involves the affected public early in the process (Blahna and Yonts-Shepard 1989; McMullin and Nielsen 1991; Gericke and Sullivan 1994). Early involvement ensures that the knowledge, concerns, and values of the public are incorporated in the design stage, rather than driving reaction to later decisions or activities. Similar

to SNEP public involvement, in an adaptive framework early involvement logically includes seeking the public's input in designing the involvement process itself.

Maintain Continuous Involvement

The public should be kept continuously informed and involved throughout the process. Adaptive processes are by definition continuous and regularly produce information that must be absorbed, evaluated and integrated into decisions. Daneke and colleagues (1983) and Howell and colleagues (1987) note the importance of continued public involvement, especially during periods when key decisions are made. Strategies for continuous involvement include providing opportunities for members of the public to become partners in the process by assuming specific roles, such as those associated with monitoring activities, that facilitate sustained participation.

Use Diverse Involvement Methods

The use of diverse involvement methods enhances the inclusiveness of public participation and provides opportunities to learn which methods are most effective. The effectiveness of different techniques for involving the public varies with the population of interest, the stage of the process, and the issues and activities at hand. Experiences in public involvement in natural resource planning and management indicate that various segments of the public respond differently to different formats. Cortner and Shannon (1993), for example, report that local wood-products workers favor informal settings and oral communication, rather than formal hearings and written comments, and Syme and Nancarrow (1992) observed that the more highly educated sectors of the public tend to participate in surveys, formal hearings and workshops. In the SNEP study, different activities were specifically structured for communities-of-place, communities-of-interest and the general public due to the unique knowledge and skills each group was able to bring to the process.

Emphasize Small Group Activities

Small group activities are the most effective public participation technique in natural resource management (Gericke et al. 1992; Blahna and Yonts-Shepard 1989). Most citizens prefer dialogue in small groups and other methods that involve two-way communication and shared decision-making (Cortner and Shannon 1993). Gericke and Sullivan (1994) note that meetings where individuals are seated as equals around a table in an informal setting have different results from those where uniformed agency personnel stand at the front of the room.

Be Inclusive

To be effective and democratic, public involvement must be inclusive and representative of all stakeholder groups, including communities-of-interest and communities-of-place. Inclusive public involvement requires that specific involvement techniques should be targeted to specific populations and activities. Moreover, the success of individual techniques should be evaluated based on their effectiveness in reaching target groups rather than in mere numbers of participants. In gathering local knowledge, for example, workshops may attract a large number of participants, but the few individuals with the greatest knowledge to offer—usually long-term local residents—are often the least likely to respond to open houses or workshops. Inviting people personally and providing forums with which they are comfortable reaches beyond those most motivated to participate. Greater societal participation in the design of adaptive management projects will lead to a wider potential array of treatments for scientific analysis as the diverse views and experiences offered by the public challenge both scientific paradigms and management dogma.

Daneke and colleagues (1983) found that public involvement practitioners were likely to be more concerned with organized interest groups and political power than inclusiveness, favoring public meetings that were often influenced by organized groups. Cortner and Shannon (1993) note that groups that feel alienated, due in part to perceived threats to their resource-based lifestyle, are likely to extend their disaffection towards planning processes. Yet, as Prisco (1983) points out, it is these groups that may be most directly affected that should be actively encouraged to participate.

Recognize and Incorporate Local Knowledge

The active development and incorporation of local, or indigenous, information can reveal critical knowledge about resources, patterns and processes, and even management actions that are not part of the common scientific information base. People who live and work within or near ecosystems know much about them, particularly those who have done so for several decades or have multi-generational ties to certain areas. Local experience with resource management on private lands may provide valuable insight and historical information. Sturtevant and Lange (1995) provide an example of agency foresters expanding their understanding of forest stand dynamics and thinning regimes upon examining privately owned forests and discussing management techniques with private landowners. Local involvement "facilitates learning from local knowledge and reflects local concerns" (Slocumbe 1993).

The incorporation of local knowledge into the adaptive management process may challenge the notions of researchers and managers of scientifically "valid" data. Local knowledge, however, should augment, not supplant scientific

information. Instituting a formal process for documentation provides an opportunity to identify the strengths and limitations of this information as well as identifying inconsistencies and competing understandings.

Rely on the Public to Define Social Values

Sustainability in ecosystem management is defined by the interaction of social values and ecological conditions. Managing successfully for sustainability depends upon public awareness and the adaptation of behavior to knowledge about an ecosystem. Management units include people, their social and economic activities and their shared and individual values (Slocombe 1993). Information development, therefore, must include knowledge of social well-being within ecosystems as well as social values affecting management. Social values may change more rapidly than ecological conditions, but it is important to recognize that they may do so in response to changes in the ecosystem, particularly when restoration is needed and/or the supply of goods and services are disrupted.

The public offers critical input in identifying expected outcomes and indicating evaluation procedures necessary to maintain public trust. In recommending a proactive public involvement strategy for the then intact AT&T Corporation, Toffler (1985) noted that timely information about changes in social structure and values can only come from the public, "whose members are, in fact, involved in these changes." Assessments of social values often rely on statistical surveys and aseptic analyses of secondary data designed and conducted by researchers removed from subject populations. While these are useful information gathering mechanisms, their veracity and acceptability are greatly increased by providing opportunities for the affected public to assist in both the design and the interpretation of results.

Make Information Accessible

Participatory, collaborative processes in adaptive management can only be achieved if all information necessary for effective decision-making is equally accessible to all participants, including the public. Knowledge and information are central to the process of adaptive management. Greater information access increases opportunities for public participation and trust, and can lead to further exchange and improvement of information as it is shared, evaluated and compared to local observations. Processes for sharing existing information, however, are often limited. Local communities and interest groups generally do not have access to the range of data and information that is available to management agencies and research organizations, thereby constraining dialogue in the adaptive process. Improvements in information accessibility must also address the capacity of the participating public to fully use and understand data and other information. Communities, then, must also have access to appropriate information tools.

Critical information technologies such as geographic information systems (GIS) must be readily shared in order to make information truly accessible. Moreover, the presentation and format of available information must be appropriate to the needs and capabilities of all potential users, not only those with access to and understanding of the latest technology.

Foster Positive Working Relationships

Integrated adaptive management requires developing and maintaining healthy relationships among the primary players in the processes. Hostile relationships are lethal to adaptive processes; people distrust each other, are unable to communicate productively, and ultimately are incapable of reaching decisions and implementing them. Healthy relationships develop when participants are open and clear with each other about actions or steps which are taken, differences are acknowledged, and all parties work together to find solutions (Carpenter and Kennedy 1988).

Clearly Define Roles, Responsibilities, and Realistic Expectations

Participants must be clear about roles and responsibilities for effective participation (Cortner 1995). The role of the public cannot be limited to expressing preferences and values, nor should individuals enter the process with greater aspirations for affecting the final outcome than is politically, scientifically or legally possible. Nothing dissolves public support and trust more than having the process of collaboration build up expectations and then hit barriers which prohibit implementation. Administrative and scientific opportunities and limitations must be made clear at the beginning and throughout the process. Decision-makers, in particular, must be clearly identified. As a continuous cycle, adaptive management provides opportunities for participants to assume different roles and responsibilities at different stages. Clear communication of the extent of these roles is essential.

Promote Facilitative Leadership

Multifaceted leadership must be recognized and encouraged in order to stimulate an atmosphere of creativity and inclusiveness. Sirmon (1993) describes the ideal agency leader as a facilitator and guide who is more than a conveyor of the community of interests, but also an effective intervener and one who actively participates in dialogue. A leader, Sirmon adds, should also be an educator, a provider of data, a developer of viable alternatives, an interpreter of law and regulation, and a representative of those not able to participate. These traits are important to adaptive management on federal land where public agencies dominate the landscape. In general, however, the leadership necessary to sustain adaptive management processes may not always come from government agencies, even when agencies are instigators of the process. Integrated

adaptive management benefits from leaders who promote the process itself rather than any individual project or goal. Leaders may emerge as those participants in adaptive management—whether managers, researchers or members of the public—who act as catalysts to the process, encouraging participation and innovation and fostering a climate of trust. It is these individual leaders who should be encouraged, to the extent possible, to continue their facilitative efforts in order to foster a vital and sustainable integrated adaptive process.

Be Flexible

Adaptive processes must be flexible ones, particularly during the critical creative phase of designing management experiments. A conscious effort must be made to develop a process where rules, regulations, dogma and political agenda are not allowed to impede or distort the process of social learning. Flexibility has proved to be an important element in the success of public involvement and conflict resolution activities. Plans developed with an understanding that changes might occur in the time frame, scope of issues, type of activities and number and type of participants as the project unfolds are more likely to succeed in the long run. Rigidly adhered to processes are an additional source of conflict for the manager (Carpenter and Kennedy 1988). Walters (1986, viii) exhorts, "An essential feature of dealing adaptively with uncertainty is to reject recipes and rituals, in favor of a search for better processes to promote imagination and learning." As with any activity in a adaptive framework, public participation approaches should be evaluated and adjusted.

Provide Open Dialogue for Information Synthesis and Evaluation

At the critical stage of synthesis and evaluation of information, where science, experience and social values mix, open dialogue is essential. As information is generated through adaptive management, the public collaborates with managers and scientists in synthesizing new information, evaluating how well management activities meet their objectives, and generating alternative hypotheses (the next experiment) and new management goals. If a set of measures can be agreed to, participants in the evaluation process can determine the overlap between what is biologically possible and what is socially desirable.

Ravetz (1986) notes that as society's knowledge increases, our relevant ignorance increases even more rapidly. He states, "Coping with ignorance in the formation of policy for science, technology, and environment is an art which we have barely begun to recognize, let alone master." Whatever knowledge may be gathered through adaptive management, then, will never be enough to make "pure" scientific decisions. Evaluation of information derived from adaptive management involves considerable interpretation of data couched in a framework of experience, scientific knowledge and social

values. Inclusion of the public in this process broadens the scope of the evaluation dialogue, and is critical to the social learning process. Noting that the principal of self-discovery is an important element of adaptive policy design, Walters (1986) suggests that "people only change their basic attitudes when they devise the arguments to do so for themselves."

CONCLUSION

In this paper we offer an integrated adaptive management approach because the role of the public in adaptive management has not yet been clearly articulated. Also, based on lessons from traditional resource management and public involvement over the past three decades, adaptive processes that do not provide an active role for the public will likely fail. Integrated adaptive management explicitly recognizes the role of the public alongside that of managers and scientists, and the value of information that is generated and considered through the interaction of these principal groups.

Integrated adaptive management challenges current institutional arrangements and requires support from community stakeholders and broader communities-of-interest, as well as the scientific community and managers. It requires opening up decision processes and, within legal and administrative constraints, sharing responsibility among managers, scientists and the public for decisions and for the development of information upon which they are based. This inclusive approach advances the social learning objectives of adaptive management by providing a forum to generate ideas and improve knowledge and understanding, and offers opportunities to build trust and broaden support for natural resource management activities. Allowing people to own science by making it accessible through adaptive management permits stakeholders to question assumptions, re-interpret findings, seek applications and develop better process and solutions.

The integrated adaptive public participation process used in SNEP proved time consuming, but by actively involving the public in an adaptive process, fears about the study were reduced and better integration of public knowledge and values into the study was achieved. Perhaps most importantly, diverse groups now view the SNEP study as a valuable source of information and ideas rather than an inflexible plan. Hence the study is just one part of a long-term adaptive process—one in which the public is now actively and cooperatively engaged—which will lead to improved management of the Sierra Nevada.

The emerging paradigm of adaptive management parallels the evolution of the public's role in natural resource management. While neither adaptive management nor increased active public participation are panaceas, the union of the two into an integrated adaptive management process offers opportunities to craft reasoned solutions to resource manage-

ment problems while advancing society's knowledge and understanding of ecological processes. Integrated adaptive management presents a real opportunity to strike a balance between scientific management of natural resources and democratic involvement in decision-making.

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Process-Oriented Public Involvement Techniques

Public involvement techniques such as consultations, conflict resolution and conflict management, and collaborative problem solving are important tools for engaging the public in integrated adaptive management of public land. These process-oriented techniques have been increasingly and successfully used in public participation activities associated with land management activities over the last two decades. Agencies and other management organizations have been increasingly turning to consultative activities and process-oriented techniques drawn from the rapidly evolving fields of conflict resolution, conflict management and collaborative problem solving. They supplement standard newsletters, questionnaires, interviews, surveys, polls, and public meetings traditionally used to gather and disseminate information. Recognizing the need for more active and inclusive forms of public involvement, and in response to a failure of past public involvement activities, agencies and management organizations have turned to these techniques.

CONSULTATIONS

One way that agencies and other organizations widen communication is through the use of advisory groups, workshops, focus groups, dialogue groups and open houses. Face-to-face dialogues and discussions, termed consultations, are used to identify issues, explore options and, to a lesser degree, develop recommendations. In many cases the exchange of information, clarification of issues, and discussion of options through these various consultative efforts can reduce public concerns sufficiently to permit projects or policies to move forward (Creighton et al. 1983).

CONFLICT RESOLUTION AND CONFLICT MANAGEMENT

Conflict resolution and conflict management activities have been used to expedite the resolution of issues by drawing to-

gether representatives of conflicting parties and other affected stakeholder groups and identifying solutions that all parties can support. The goal of conflict resolution is to reach agreements on conflicting issues among affected parties while the goal of conflict management is to handle conflict productively. In either case, managing a conflict outside the legal arena permits the parties, and subsequently the public, to examine a broader range of issues.

Conflict resolution in natural resource management initially evolved from two separate backgrounds. Mediators with experience in labor-management negotiations worked with conflicting parties to structure a process to facilitate understanding of the range of issues and interests, develop acceptable options, and reach agreements. Following the labor management model, many mediators intervened only after negotiating parties reached deadlocks characterized by highly polarized conflict. Mediators with backgrounds in peacemaking and organizational development convened disputing parties earlier in the process to improve communication, exchange critical information, or clarify their particular issues and concerns. While some interventions result in joint options or recommendations, others focus on conflict management rather than agreement, and are known as policy dialogues (Gusman 1981), workshops, and information sharing sessions. In each of these efforts, mediators help conflicting parties work more effectively with each other.

Negotiation is the principal tool of conflict resolution, and these efforts are often called roundtables, mediations or negotiations. Negotiations typically rely on face-to-face exchanges between affected parties, but when direct meetings are psychologically or logistically difficult mediators may use shuttle diplomacy or single-text negotiations. In shuttle diplomacy mediators move back and forth between parties in conflict to achieve agreement. In single-text negotiation a mediator discusses the case and possible solutions with parties, creates a draft of an agreement and then circulates the draft among parties asking for ways to improve it. The draft continues to be circulated and revised until all parties are satisfied with the document.

In contrast to more general public involvement activities, conflict resolution activities in natural resource management have involved the public as decision-makers, or as integral players in a decision-making process, along with representatives from a responsible management organization and other affected parties. Conflict resolution shifts the dynamics from adversarial behavior, where the winner-takes-all, to joint problem solving where parties work together to produce a mutually acceptable solution. Significantly, much of the responsibility for making decisions shifts to the primary stakeholders.

COLLABORATIVE PROBLEM SOLVING

"Consensus building" initiatives or "collaborative problem solving" programs are aimed at reaching agreements earlier in the planning cycle before parties become deeply entrenched in their positions. Similarly, "consensus decision-making" engages the public in discussions about development of policy and plans and their implementation, and seeks the consensus of stakeholders in reaching acceptable solutions.

The underlying premise of collaborative problem solving assumes that if the right people are brought together in a process that encourages learning and joint exploration of solutions, they will identify good solutions and produce results. Going beyond the search for compromise that characterizes conflict resolution, collaborative processes promote mutual education among all stakeholders and encourage the development of new options. As Gray (1989) notes, collaboration is a process by which "parties who see different aspects of a problem can constructively explore their differences and search for solutions that go beyond their own limited vision of what is possible." She adds that collaboration creates "a richer, more comprehensive appreciation of the problem among the stakeholders than any one of them could construct alone."

Most collaborative processes are initiated in response to particular problems or issues. Managers or facilitators establish agendas, suggest and enforce ground rules, offer process sug-

gestions, and in general, manage group discussion. The collaborative process ends once a plan or proposal has been approved by participating groups.

As with conflict resolution, collaborative problem solving allows the public to become a decision-maker, sharing power with managers and other traditional decision-makers. Management organizations consequently become a player, one voice among many stakeholders. As the World Bank (1995) noted in a recent study on participation agencies must "work with representatives of key interests to identify issues, jointly generate options, and seek solutions." Moreover, because stakeholders collaborate to forge options and decisions in collaborative processes there generally is little opposition to implementation. Chrislip and Larson (1994) note that collaboration is a mutually beneficial relationship between parties "who work toward common goals by sharing responsibility, authority and accountability for achieving results."

Collaborative processes are limited, however, by their typically ad hoc nature. The process ends once an issue has been addressed, and the mutual learning and working relationships that were advanced during the collaboration cease on a formal basis.

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